



6712-01

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 15

[ET Docket Nos. 10-23 and 10-27; FCC 14-2]

Level Probing Radars

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: This document modifies the Commission's rules for level probing radars (LPRs) operating on an unlicensed basis in the 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz bands to revise our measurement procedures to provide more accurate and repeatable measurement protocols for these devices. LPR devices are low-power radars that measure the level (relative height) of various substances in man-made or natural containments. The new rules will benefit the public and industry by improving the accuracy and reliability of these measuring tools, and providing needed flexibility and cost savings for LPR device manufacturers which should in turn make them more available to users, without causing harmful interference to authorized services.

DATES: Effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

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SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Report and Order and Order, ET Docket Nos.10-23 and 10-27, FCC 14-2, adopted January 15, 2014 and released January 15, 2014. The full text of this document is available for inspection and copying during normal business hours in the FCC Reference Center (Room CY-A257), 445 12th Street, SW., Washington, DC 20554. The complete text of this document also may be purchased from the Commission's copy contractor, Best Copy and Printing, Inc., 445 12th Street, SW., Room,

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Summary of Report and Order

1. By this action, the Commission modifies part 15 of its rules for level probing radars (LPRs) operating on an unlicensed basis in the 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz bands to revise our measurement procedures to provide more accurate and repeatable measurement protocols for these devices. LPR devices are low-power radars that measure the level (relative height) of various substances in man-made or natural containments. In open-air environments, LPR devices may be used to measure levels of substances such as water basin levels or coal piles. An LPR device that is installed inside an enclosure, which could be filled with liquids or granulates, is commonly referred to as a tank level probing radar (TLPR). LPR (including TLPR) devices can provide accurate and reliable target resolution to identify water levels in rivers and dams or critical levels of materials such as fuel or sewer-treated waste, reducing overflow and spillage and minimizing exposure of maintenance personnel in the case of high risk substances.

2. On January 14, 2010, the Commission adopted the Notice of Proposed Rulemaking and Order, (Notice and Order) in this proceeding, 75 FR 9850, March 4, 2010. The Notice and Order proposed to modify part 15 of the rules to allow the restricted 77-81 GHz frequency band to be used on an unlicensed basis for the operation of LPR equipment installed inside closed storage tanks made of metal, concrete, or other material with similar attenuating characteristics and also sought comment on whether to allow TLPR operation on an unlicensed basis in the 75-85 GHz band. The Notice and Order also granted conditional waivers of the restriction in §15.205(a) that bars intentional radiators in the 77-81 GHz restricted band to Siemens, VEGA,

and any other responsible party that can meet the waiver conditions specified in that decision.

Under the terms of the waivers, these parties could employ TLPR devices in this band if installed inside tanks with high attenuation characteristics (e.g., metal and concrete tanks), pending the conclusion of the concurrently initiated rulemaking.

3. Since the adoption of the Notice and Order, the Commission received an additional waiver request (disposed herein), as well as some inquiries, regarding outdoor use on additional frequencies under existing part 15 rules. To address the apparent need for a comprehensive and consistent approach to LPR devices, on March 26, 2012, the Commission adopted a Further Notice of Proposed Rule Making (FNPRM), 77 FR 25386, April 30, 2012, in this proceeding, it proposed a set of common technical rules for the operation of LPRs in any type of tanks (i.e., with low RF attenuation characteristics such as fiberglass, or high RF attenuation characteristics such as metal) as well as in open-air environments in the following frequency bands: 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz. In the FNPRM, the Commission made new proposals that treat LPR and TLPR devices the same with respect to emission limits and frequency bands of operation without any additional installation limitations. That is, a level measuring radar that complies with our proposed rules would be able to be used in any application, whether outdoors in the open or inside any type of enclosure. In adopting the FNPRM, the Commission held in abeyance all waiver requests regarding LPR operations pending final action in this rulemaking proceeding.

4. The FNPRM's technical and operational proposals were based in large part on measurements and analytical work conducted in support of the European Telecommunications Standards Institute (ETSI) LPR Technical Standard for LPR devices. This standard is based on the research, modeling and recommendations provided by the Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT) in ECC Report 139, a study of the co-existence of LPR devices with

various authorized services in the 6-8.5 GHz, 24.05-26.5 GHz, 57-64 GHz, and 75-85 GHz and adjacent frequency bands.

5. LPR devices have operated for years under the general technical standards for intentional radiators in §15.209 of the Commission's rules, primarily inside metal or concrete tanks which substantially attenuate radio frequency energy from the LPR antenna. Although the Commission will continue to certify LPR under this rule, manufacturers have had a difficult time demonstrating compliance with the rule's low emission limits for certain types of level-measuring applications in fiberglass or polyethylene (plastic) tanks or in open air. Such difficulty occurs because reflections off of the surfaces being measured attenuate inconsistently due to devices' orientation and the material being measured, the physical shape of which can change continuously depending on the material and circumstances. Thus, it is difficult to make a measurement that will validly apply to all installations of a given LPR device when measuring LPR emissions in situ for certification purposes. The amended rules adopted in the Report and Order establishes a comprehensive and consistent approach that would provide simplicity and predictability for authorizing LPRs for level-measuring applications in any type of tank or open-air environments, in the following frequency bands: 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz. Certification of LPR equipment under the new rules will require measuring emissions in the main beam of the LPR antenna, while adjusting the emission limits in part 15 for devices so measured to account for the significant attenuation that occurs upon reflection of those emissions. These emission limits will protect any nearby receivers from encountering any increase in interfering signal levels. The new rules will benefit the public and industry by improving the accuracy and reliability of these measuring tools, and providing needed flexibility and cost savings for LPR device manufacturers which should in turn make them more available to users, without causing harmful interference to authorized services. To the extent practicable, these amended rules harmonize our technical rules for LPR devices with similar European standards, thus improving the competitiveness of U.S. manufacturers in the global economy.

6. The Order, also dismissed as moot a request by VEGA Americas, Inc. (formerly Ohmart/VEGA Corporation) (VEGA) to waive the use restrictions in §15.252 so that it can operate an LPR device in the 26 GHz band.

7. In the Report and Order (R&O), the Commission adopted a comprehensive set of technical and operational rules for authorizing LPR devices operating on an unlicensed basis in the 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz in any RF level-measuring application, whether in an open-air environment or inside any type of enclosure. Section 5.256 will allow for the introduction of more diverse applications of LPR in several frequency bands and improve the accuracy and reliability of these level-measuring tools beyond what is achievable under §15.209. The new rules will also help to streamline equipment development and certification of LPR devices, allowing manufacturers to take advantage of economies of scale by marketing the same LPR device for a variety of RF level-measuring applications, as well as provide a simplified method for measuring the radiated emissions from these devices.

8. The Commission's action here addresses a significant obstacle to authorizing LPR devices under the current rules, namely, the difficulty of obtaining repeatable and accurate radiated emission measurements. Unlike most part 15 devices that operate with the emitter/transmitter pointing horizontally, LPR devices must operate in a downward-pointing position such that their emissions are directed toward the substance to be measured located. The Commission's current rules are designed for devices with horizontal emitters or transmitters, and require measuring radiated emissions at a 3-meter horizontal distance from the radiating source, with the radiating source pointed directly at the measurement antenna (boresighted), while varying the measurement antenna height from 1 meter to 4 meters to obtain worst-case emissions. This compliance measurement practice does not yield repeatable results when LPR emissions are measured in situ, i.e., with the radar pointing down toward a representative substance. This difficulty arises because the current measurement procedures are optimized for directly measuring device emissions, whereas in situ measurements for LPRs would essentially only

measure reflected emissions, which can vary erratically, depending on the nature of the surface at the precise moment(s) of measurement. To obtain repeatable and accurate emission test results, manufacturers can measure LPR emissions directly in the main beam of the antenna for certification compliance purposes. However, when so measured, the general emission limit in §15.209 constrains LPR emissions to such a low level that the device cannot be used for most high-precision, high-accuracy applications, such as measuring volatile liquids inside non-corrosive fiberglass tanks or water level in rivers, for which LPR devices need higher power than a main-beam measurement permits under our current rules to achieve the necessary precision in these applications. The part 15 rules that permit higher power for similar wideband devices, such as §§ 15.250 and 15.252, contain frequency and operational restrictions which preclude the certification of LPR devices absent a waiver, which some LPR manufacturers have sought.

9. Due to the normal operating condition of an LPR where it radiates in a downward direction, potential victims of interference from LPRs are unlikely to be located in the main beam and subject to the maximum radiated power from the device. Rather, it is the reflected emissions from LPRs - which will be lower than the main-beam emissions - that present the greatest potential for harmful interference. Because of this, and the difficulty in measuring reflected emissions discussed in the R&O, the Commission amended part 15 to add new §15.256 to increase the (main-beam) emissions limit for LPRs to a level that will still ensure that the reflected emissions remain within the maximum permitted level. This will allow LPR devices to achieve better accuracy in certain applications while not increasing the potential of causing harmful interference to other devices. The Commission also requires that all spurious or unwanted emissions from LPR devices not exceed the general emission limits in § 15.209. Measuring a main beam emission limit rather than measuring reflected emissions will make certification measurements simpler, repeatable and more reliable, and allow certified LPR devices to be used either in tanks or in open-air environments without increasing interference to any authorized services. LPRs will have the higher power and bandwidth needed without

manufacturers having to request waivers of operational restrictions in §§15.250 and 15.252 for similar wideband devices as they have in the past. To further protect authorized services operating in the same and adjacent frequency bands, the Commission will (1) require the LPR antenna to be dedicated or integrated as part of the transmitter and installed in a downward position; (2) limit installations of LPR devices to fixed locations; and (3) prohibit hand-held applications of LPR and the marketing of LPR devices to residential consumers.

10. The Commission will continue to permit certification of LPR devices under the provisions of § 15.209 of its rules as unlicensed intentional radiators. Certification of LPRs under § 15.209 provides an alternative for those manufacturers who may not need higher power or who want to operate in frequency bands that are not covered by the new LPR rules. The Commission modified § 15.31 of the rules to provide compliance testing guidance for those manufacturers who choose to certify LPR under §15.209.

Certification under Section 15.209

11. The Commission will continue to certify LPRs under §15.209. Although the new LPR rules are intended to simplify measurement procedures and permit certification of LPR devices that could be used both in any type of tank and outdoors in specific frequency bands, including the restricted band 75-85 GHz, the Commission recognizes that the new rules' frequency and technical requirements may limit options for some applications. LPR certified under §15.209 may operate in any non-restricted band at much lower emission limits than permitted under the new LPR rule and, would demonstrate compliance by measuring their worst-case emissions in the main beam of the antenna; peak emissions for pulsed LPRs may be reduced further because the rules require that peak power output use a pulse desensitization correction factor (PDCF). The Commission observes that legacy LPR operations certified under § 15.209 have primarily operated in enclosed tanks with high attenuation levels and have not caused harmful interference over the years, but manufacturers have had difficulty in demonstrating compliance with §15.209 for other types of applications (e.g., open-air operation).

12. While TLPRs are currently receiving certification under §15.209 using in situ measurement procedures, the Commission will provide specific measurement guidelines for certifying LPRs that are intended for installation inside enclosed tanks made of metal or concrete to promote consistency and repeatability. Some manufacturers who have operated LPRs inside metallic and concrete tanks for many years request that, for these uses, they continue to be permitted to demonstrate compliance with §15.209 general emission limits by measuring radiated emissions outside a representative test tank with the LPR installed inside, as they have in the past. These parties point out that a tank wall made of metal or concrete provides a substantial RF shield, and they request that LPRs intended for this type of application not be subject to any further restriction on antenna beamwidth or main-beam emission limits, as long as emissions measured at 3 meters outside of the tank meet the general emission limit as currently required by §15.209.

13. The Commission finds that there is good reason for providing specific measurement procedures that allow more flexibility for certifying, under §15.209, LPRs intended for installation inside enclosures made of metal or concrete. At the same time, the rules will continue to permit manufacturers to demonstrate compliance with the §15.209 general emission limits as they have in the past, by measuring radiated emissions outside a representative enclosure with the LPR installed inside. As observed in the Notice and Order, TLPR emissions outside of enclosed tanks with very high RF attenuation characteristics, e.g., steel or concrete, will likely be minimal when considering the enclosure's attenuation coefficient in addition to the absorption characteristics of the target material (liquid or solid), and thus, any reflected signal will be mostly contained within the tank. Because metal and concrete enclosures provide substantial RF attenuation, the power in the main beam of the antenna installed within such tanks can be increased beyond the limits required for unenclosed devices, thus permitting better measurement performance in LPR applications (e.g., higher power may permit the LPR to better focus and receive accurate echoes from the substance to be measured below the LPR), but the potential for

harmful interference is significantly diminished because the signal can be substantially attenuated by the enclosure itself. The Commission also notes that this addresses MCAA's concerns regarding the difficulties of accommodating some antennas in existing openings of some metal and concrete tanks. Because other materials do not provide the same attenuation, the Commission limits these measurement procedures to LPR devices intended to be used only in completely enclosed metal or concrete tanks. The Commission modified §15.31 of the rules to provide compliance testing guidance for those manufacturers who choose to certify LPR under §15.209

New Section 15.256

Frequency Bands of Operation

14. As discussed most LPR devices on the U.S. market currently operate on an unlicensed basis in frequencies around 6 GHz, 24 GHz, or 26 GHz under the general emission limits of §15.209 of the Commission's rules. These operating frequency ranges are chosen by the different LPR manufacturers to accommodate various level-measuring applications. As proposed in the FNPRM, the Commission will allow LPR devices certified under the new technical rules adopted herein to operate both in any type of enclosure and in open air, in the following frequency bands: 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz. The new rules addresses the specific spectrum needs and restrictions in the U.S., and to the extent practicable, harmonize our technical rules for LPR devices with similar European standards.

1. 5.925-7.250 GHz frequency band

15. The Commission authorizes unlicensed wideband transmitter operation within the 5.925-7.250 GHz band under §15.250 of its rules. LPR devices seeking higher power and wider bandwidths than provided therein in order to improve their performance cannot be authorized under this rule absent a waiver of certain usage restrictions in the rule. In this band, licensed users include non-Federal fixed, fixed satellite, and mobile services from 5.925 GHz to 7.125 GHz; and Federal fixed and space research services (deep space & Earth-to-space) from

7.125 GHz to 7.250 GHz. Part 15 transmitters operating in this band are prohibited from being used in toys or operating on board an aircraft or satellite. They cannot utilize fixed outdoor infrastructure, including outdoor-mounted transmit antennas, to establish a wide area communications network. The Commission observed in the FNPRM that it would consider LPR operation in the 5.925-7.250 GHz band, including permitting limited fixed outdoor installations, consistent with the intent underlying the usage restrictions in §15.250, because in this regard, LPRs are single, i.e., relatively isolated, transmitters whose individual operations outdoors would not result in the establishment of a local area network of transmitters.

16. The Commission declines to expand the frequency band for LPR devices under the new rules at this time. First, the technical and operational requirements that it adopted under the new rules are based on analytical work that encompasses frequencies from 6.0-8.5 GHz for LPR operations; therefore, the Commission finds that compatibility of these limits with authorized services below 6 GHz has not been studied. Neither, Sutron nor any other commenter provided technical analyses or studies to support compatibility of LPR operating at the proposed higher emission limit with incumbent operations below 5.925 GHz. Although Sutron argues that greater bandwidth would yield greater level measurement resolution, neither it nor any other party indicated with any specificity, much less demonstrated, how permitting a higher resolution than that which can be attained under the rules adopted herein would further the public interest. The Commission concludes that, without further analyses, it would be imprudent to permit a wider bandwidth than what it proposed in the FNPRM and to expose incumbent services unnecessarily to additional radio noise. Further, the Commission and the NTIA are involved in active discussions relating to the 5.850-5.925 GHz bands. Pending the outcome of these activities, the Commission finds that LPR devices should be confined to the 5.925-7.250 GHz band when operating at the higher emission limit it adopted herein for LPR devices. Manufacturers requiring wider bandwidth than permitted under new §15.256 may seek authorization, by demonstrating compliance under §15.209.

2. 24.05-29.0 GHz frequency band

17. In the FNPRM, the Commission proposed to permit LPR operation in the 24.05-29.00 GHz band to provide expanded flexibility for optimizing LPR applications and to enhance global marketing opportunities by more closely harmonizing with ETSI in this frequency range. Currently, the Commission authorizes unlicensed wideband operation in the 23.12-29.0 GHz band under §15.252 of its rules. LPR devices seeking higher power and wider bandwidths to improve their performance cannot be authorized under this rule absent a waiver of certain usage restrictions in the rule. While some LPRs currently operate in this band, their utility is limited by the restrictions of §15.252. This band is shared between Federal and non-Federal services. Authorized licensed operations include radiolocation, Earth exploration satellite service (EESS) (active), amateur, fixed, inter-satellite, radionavigation, radiolocation satellite (Earth-to-space), fixed satellite (Earth-to-space), mobile, standard frequency and time signal satellite (Earth-to-space), space research (space-to-Earth), and EESS (space-to-Earth) services. Unlicensed transmitters operating in the 23.12-29.0 GHz band subject to this rule must be mounted on vehicles and cannot be used in aviation applications. Finally, in the FNPRM, the Commission observed that the proposed frequency band is wider than that which ETSI has adopted; however, it believes that the risk of interference to incumbent authorized services from LPR devices will be no greater than it is from part 15 vehicular radars currently operating in this band because LPR devices operate in a fixed downward-looking position, and because there have been no interference complaints related to the operation of these part 15 radars, which unlike LPRs do not always operate in a downward position. There were no comments related to our proposals in this band, and for the reasons stated, the Commission will allow LPRs to operate within the 24.05-29 GHz frequency band at the radiated emission limits under §15.256.

3. 75-85 GHz frequency band

18. Apart from a handful of specified frequency bands, spectrum above 38.6 GHz, including most of the 75-85 GHz band, is designated as “restricted” in §15.205 of the rules.

Unless expressly permitted by rule or waiver, unlicensed devices are not allowed to intentionally radiate energy into a restricted band, in order to protect sensitive radio services from harmful interference. The Commission has permitted unlicensed operation within specific frequency bands above 38.6 GHz, i.e., 46.7-46.9 GHz, 57-64 GHz, 76-77 GHz, and 92-95 GHz.

19. The 75-85 GHz band is shared between Federal and non-Federal services. Authorized operations in this band currently include radio astronomy, fixed/mobile/fixed satellite, mobile satellite, broadcast and broadcast satellite, radiolocation, space research (space-to-Earth), amateur and amateur satellite services. In addition, unlicensed vehicular radars are currently permitted to operate in the 76-77 GHz band. In the FNPRM, the Commission observed that the services in this band typically employ highly directional antennas to overcome the relatively higher propagation loss that occurs at these frequencies. The Commission stated its belief that LPR operation in the 75-85 GHz band would not adversely affect incumbent authorized users, because this band is currently sparsely used and the propagation losses are significant at these frequencies, making harmful interference unlikely beyond a short distance from the LPR device.

20. The Commission has authorized vehicular radar operation, including Foreign Object Debris (FOD) detection fixed radar operations at airports, in the 76-77 GHz band under its part 15 unlicensed rules; and a rulemaking petition is now pending asking that it permit unlicensed vehicular radars to operate in the 77-81 GHz band as well. It is further noted that the Commission has modified § 90.103 of the rules to permit the certification, licensing and use of FOD detection radars in the 78-81 GHz band. The Commission finds that FOD radars and LPR devices would most likely not operate in the same geographical location, because the FOD radars are only authorized to operate at airports whereas LPR typically operate in industrial or remote areas. However, even if they were co-located, at these frequencies, the potential for harmful interference to FOD radars from LPR is extremely unlikely, given the substantial free-space propagation losses and the extremely narrow beamwidths of the FOD radar. As for spectrum sharing between vehicular radars and LPR, the Commission believes that LPR devices will be

able to co-exist successfully with vehicular radars because the LPR is installed in a downward-looking position at fixed locations and the main-beam emission limits have been carefully calculated to avoid harmful interference to other radio services. The Commission further finds that the extreme propagation losses of radio signals at these frequencies would mitigate any potential harmful interference beyond a very short distance from the LPR device.

21. Accordingly, the Commission will allow LPR to operate within the 75-85 GHz frequency band, at the radiated emission limits specified in §15.256. To permit LPR operation in the 75-85 GHz band, it also modified §15.205 of the rules to remove the prohibition on intentional emissions in this band for LPR devices authorized under the new rules.

Technical Requirements

22. To maintain the existing interference protection criteria to authorized services in the frequency bands covered by §15.256 for LPR operations, the FNPRM invited comment on establishing requirements for the following interdependent parameters: main-beam radiated emission limits, antenna beamwidth, and antenna side-lobe gain. Main-beam emissions must be measured with the LPR antennas “boresighted” to produce the maximum realizable antenna coupling. The main-beam emission limits adopted will allow an LPR device to operate at higher peak levels than part 15 currently permits but would continue to provide the same level of interference protection to authorized services as any other part 15 device operating under the general emission limits, provided that the LPR antenna always maintains a downward position and utilizes a relatively narrow beamwidth. Because the LPR is always pointing downward and direct emissions from the LPR antenna are focused by a narrow beamwidth toward the substance being measured, it is unlikely that emissions reflected from this material or from the ground surface would cause interference to a potential victim receiver located at any height relative to the LPR due to the significant attenuation of the reflected signal.

23. The technical and operational requirements proposed in the FNPRM and discussed below are based on analytical work performed by the ECC in support of the ETSI Technical

Standard for LPR devices. This standard specifies compliance measurements based on main-beam emission limits. To determine the maximum allowable radiated emission limits for LPR devices operating in each authorized frequency band, the ECC studied the interference potential of an LPR by taking into account reflected emissions within a hemispherical boundary around the LPR device. The ECC assumed a worst-case material reflectivity coefficient and determined the main-beam emission level that correlates to the appropriate reflected emission level. The Commission finds that the analytical work of ETSI/ECC provides a reliable correlation between main-beam emissions and emissions at 3 meters from the LPR that is sufficiently conservative to conclude that the use of a main-beam emission limit rather than limits based on reflected emissions will not create a greater interference potential, thus providing strong support for the approach we are taking here. Moreover, a main-beam emission limit would represent a more realistic evaluation of interference potential and permit higher power, thus increasing the accuracy and utility of LPRs. At the same time, it will simplify compliance measurements of LPR emissions, because emissions from the LPR would be measured directly in the main beam of the antenna where maximum emissions are found, thus avoiding the measurement of reflected emissions that can be highly variable due to the variable site-related factors involved with in situ testing. Under this approach, certification measurements will be simpler, repeatable and more reliable. Accordingly, the Commission amended the rules to require that LPR radiated emissions be measured in the main beam of the LPR antenna. The Commission notes that no party opposes the use of main-beam emission measurement or the general measurement principles in the FNPRM proposed rules.

Radiated Emission Limits

24. The Commission adopted distinct radiated emission limits for LPR devices operating in each of the frequency bands, as set forth in Table 1 in the R&O. The emission limits for main-beam emissions were derived by mathematically correlating the reflected emissions from an LPR with the existing part 15 average emission limit at -41.3 dBm EIRP for devices operating

above 960 MHz –or lower levels (at -55 dBm EIRP for frequencies below 8.5 GHz). The LPR main-beam emission limits therefore would maintain the existing level of interference protection to incumbent radio services. As the Commission tentatively concluded in the FNPRM, the LPR emission limits for each of the specified operating frequency bands as measured in the main beam of the LPR antenna will adequately protect against harmful interference to incumbent authorized services in any of the proposed frequency bands, based on several factors. First, LPR devices will be required to utilize downward-focused narrow-beam transmit antennas, which are also needed to optimize level-measuring performance; therefore, the only LPR emissions likely to be incident on an incumbent receiver within proximity will be reflected from the target material and thus significantly attenuated. Second, the LPR emission limits are consistent with the results expected from application of the existing limits in radiated in situ measurements and therefore will maintain the existing level of protection afforded to incumbent authorized services under existing rules and their attendant measurement procedures. Third, as the operating frequency increases, the propagation path loss also increases as a result of the increased attenuating effects on radio waves from intervening objects and atmospheric conditions, and the Commission accounts for this by varying the permitted radiated emission limit for each frequency band. None of the commenters took issue with any of these factors or with the conclusion that the proposed limits will provide adequate protection against harmful interference. Moreover, adoption of several operational restrictions, in addition to these emission limits, provides further assurance that authorized services will not be subject to harmful interference.

25. The Commission agrees with MCAA that because STL links are installed high off the ground with highly directional receive antennas, received interference from LPRs that point downward toward the measured substance is highly unlikely. It does not believe that EIBASS is correct in comparing LPR devices to other unlicensed narrowband part 15 devices that operate under §§15.209 and 15.35(b) of its rules because LPR devices are wideband devices that are more similar to unlicensed devices operating under §15.250 of the rules. While it is true that the

proposed main-beam peak emission limit for LPR is 7 dB higher than the peak emission limit in §15.250, i.e., 0 dBm peak EIRP, with the LPR antenna pointing down toward the substance being measured, only reflected emissions (which typically are already attenuated from the direct emission levels) would be expected. Because of reflection losses, LPR emission levels are therefore lower than other unlicensed wideband devices operating in the same frequency range. Further, because STL antennas are also directional in nature, there are additional antenna losses in the potential STL victim receive antenna, unless the LPR emissions are in the STL antenna main beam, which is a highly unlikely circumstance. The Commission further notes that the number used to derive the LPR equivalent main-beam emission limit at 6 GHz is actually 14 dB lower (at -55 dBm EIRP) than the average emission limit in §15.250 (at -41.3 dBm EIRP) for part 15 devices operating in the same bands as STLs. Therefore, in the 6 GHz frequency range, the proposed main-beam emission limit is constraining any potential reflected emissions from an LPR to a level lower than the existing interference protection level for authorized services from unlicensed devices, resulting in a 14 dB additional interference protection margin for authorized services as compared to that provided by other part 15 devices. Furthermore, there has not been any case of harmful interference to STL links from other part 15 devices that currently operate in the same frequency band (devices that do not even have the interference-avoiding characteristic of being pointed downward). The Commission further notes that LPR devices are not by their nature used to establish local or wide area networks because LPRs are designed to measure the level of a substance at a single, circumscribed site (e.g., a pile of coal or gravel, or water in a tank or under a bridge).

26. Aggregate emissions of LPR devices. The Commission observes that in calculating the LPR main-beam emission limits, the ECC Report 139 did take into account the co-existence between LPRs and EESS operating in the EESS allocated frequencies. ECC simulations show that in the most critical scenarios, there are wide margins of safety against harmful interference to EESS, even when using a very conservative number for the possible future growth of LPR

devices in the long-term. CORF did not dispute these ECC analyses. The Commission therefore finds that there would be minimal or no effect on EESS or non-GSO satellite services from LPRs operating in the 24-26 GHz frequency range, and thus the Commission does not adopt aggregate emission limits for LPR in these bands. The Commission also observed that LPR, as all unlicensed devices operating under part 15 of the Commission rules, are subject to the non-interference rules in §15.5.

27. Unwanted (harmonic and spurious) emissions of LPR devices. The Commission notes that similar part 15 equipment operating under §15.250 in the 5.925-7.250 GHz band and under §15.252 in the 23.12-29 GHz band are subject to unwanted emission limits that are much more stringent than what the Commission proposed for LPR devices, because it expects that LPRs will have a low interference potential as they operate in a fixed downward position. However, the Commission does not believe that LPR unwanted emissions should be allowed to be as high as -34 dBm EIRP as Hach requests for LPRs operating in the 26 GHz frequency range, because, the Commission goal is to maintain the existing interference protection criteria (*i.e.*, the part 15 general limit of less than -41.3 dBm EIRP) to authorized services from LPR' unwanted emissions. Further, the same principle of establishing an unwanted emissions limit at 20 dB below the fundamental limit would allow unwanted emissions from LPRs operating in the 80 GHz range to be as high as -23 dBm EIRP. The Commission finds that the -41.3 dBm EIRP general emission limit of §15.209 is appropriate so as to constrain any LPR unwanted emissions to the existing level of interference protection for incumbent users of the spectrum and Hach has not presented evidence that this is an inappropriately strict level for part 15 devices in general or for LPRs in particular. The Commission therefore denies Hach's request for LPR unwanted emissions to be 20 dB below the fundamental emissions.

Antenna Requirements

28. An antenna converts electrical signals traveling along a transmission line into electromagnetic energy that is radiated into the environment. Antennas such as those used in

LPR devices are directional, in that the energy being transmitted is concentrated into one direction. If the gain characteristics of the antenna are plotted, a pattern is formed that consists of a single main lobe in the direction in which the majority of the energy is transmitted. In addition to the main lobe, there are multiple side lobes in undesired directions. The magnitude of the main lobe is called the gain of the antenna, and is compared to the magnitude of an isotropic antenna that transmits energy equally in every direction. Because an antenna can only focus energy, but cannot create additional energy, a higher gain (more energy) in the main lobe of the antenna can be realized only when the beamwidth of the main lobe is narrowed, accordingly reducing the gain in the side lobes (lessening the energy in other directions). In other words, the beamwidth, main-beam gain, and side-lobe gain of the antenna are all interdependent. Since the Commission is specifying a maximum antenna beamwidth, for any given antenna, there is necessarily a minimum antenna gain that corresponds to the maximum beamwidth and a corresponding maximum side-lobe gain as well.

(i) Antenna Beamwidth

29. In the FNPRM, the Commission proposed an antenna beamwidth no greater than 12 degrees for frequencies below 57 GHz and no greater than 8 degrees in the 75-85 GHz bands. Because the main source of the scattering of LPR emissions is the interaction with the surface being measured, the proposed maximum antenna beamwidth for LPRs was restricted to limit emission scattering in order to control the interference potential of LPRs to other radio services. The Commission also observed that maintaining a narrow antenna beamwidth could enhance LPR performance because a narrower beam reduces false echoes from objects other than the desired target material.

30. The Commission adopted its proposed antenna beamwidth limitations of no greater than 12 degrees for frequencies below 57 GHz and no greater than 8 degrees in the 75-85 GHz bands. First, the antenna beamwidth limits proposed in the FNPRM were designed to be consistent with the proposed main-beam emission limits, which in turn were based on ETSI

standards. As noted, harmonization of our emission limits with the ETSI limits serves to expand global marketing opportunities for U.S. manufacturers. The Commission concludes that any benefits that might result from Sutron's proposed beamwidth limits would be outweighed by the potential benefits of harmonization with European standards. Moreover, the Commission notes that a wider main beam could result in greater reflected emissions, and increase the potential for harmful interference to other spectrum users. The Commission further observes that other waterways level-measuring LPR manufacturers such as Hach state in their comments that their devices use planar antennas which have outer dimensions much smaller than a horn antenna, are less obtrusive and less susceptible to vandalism and can still meet the proposed rule for antenna beamwidth. In addition, the Commission does not find Sutron's argument about wind/snow effects on the LPR antenna compelling, because this problem could be addressed by judiciously choosing an installation location that would shield the LPR antenna from weather conditions. Accordingly, the Commission denies Sutron's request to increase the antenna beamwidth limit to 35 degrees.

(ii) Antenna Side-Lobe Gain

31. In the FNPRM, the Commission proposed a fixed side-lobe gain limit of -10 dBi for off-axis angles greater than 60 degrees. The Commission also sought comment on the necessity of establishing limits on the gain of the antenna in the side lobe region and off-axis angles.

32. The Commission agrees with Delphi that, in some cases, an LPR operating at the maximum main-beam power as proposed in the FNPRM could have side-lobe emissions that exceed the -41.3 dBm EIRP interference protection criteria in §15.209, depending on the efficiency of the antenna used and the power at which the LPR is operated. The Commission noted in the FNPRM that it did not intend any rule revisions adopted in this proceeding to permit the gain of any LPR side lobe to exceed the EIRP limit in §15.209. Therefore, it will modify the side-lobe gain limits from those proposed in the FNPRM. The Commission notes that antenna side-lobe gains correlate to main-beam gains; as the antenna main-beam gain varies, the side-lobe

gain also varies. Therefore, to ensure that LPRs provide the same interference protection to authorized radio services as other part 15 devices (i.e., maintain the general -41.3 dBm EIRP limit from §15.209 on horizontal transmissions from LPRs), the Commission adopted a side-lobe gain limits relative to the main-lobe gain, as shown in Table 3 of the R&O. The calculations for those limits are found in Appendix C of the R&O.

Automatic Power Control

33. In the FNPRM, the Commission noted that as a consequence of its proposed main-beam emission limits, all reflected emissions from the LPR device will be kept at or below the §15.209 general emission limits, and thus it did not to propose to adopt automatic power control (APC) requirements for LPR devices. The Commission sought technical analyses from parties advocating a requirement for APC to show the inadequacy of the emission limit in §15.209. No party provided comments on APC. Accordingly, the Commission did not adopt APC requirements for LPR devices.

Other Requirements

Operational and Marketing Restrictions

34. In the FNPRM, the Commission proposed, for LPR devices authorized under the higher emission limits in the new rule, that the antenna of an LPR device be dedicated or integrated as part of the transmitter and professionally installed in a downward position; to limit installations of LPR devices to fixed locations; to prohibit hand-held applications of LPR devices; and to prohibit the marketing of LPR devices to residential consumers. It stated that these restrictions are intended to protect incumbent authorized services operating in the same and adjacent frequency bands from potential harmful interference from LPRs. The Commission will require the antenna of an LPR device to be dedicated or integrated as part of the transmitter; limit installations of LPR devices to fixed locations; prohibit hand-held applications of LPR devices; and prohibit the marketing of LPR devices to residential consumers. A requirement for professional installation appears unnecessary as the Commission is requiring LPRs to be installed

in a downward position and LPRs would not function correctly if they are not pointed down toward the substance to be measured. Accordingly, the Commission is not adopting a requirement for professional installation.

35. The Commission concludes that the LPR antenna must be dedicated or integrated as part of the transmitter. It does so because, antennas used in LPR devices must satisfy the requirements for main-beam radiated emissions, beamwidth and side-lobe gain, which are interdependent, to demonstrate compliance with §15.256. By requiring a dedicated or integrated antenna as part of the transmitter, the Commission will ensure that the LPR when operated will meet the emission limits necessary to protect authorized users. The Commission also concludes that there is no need to adopt a rule to require professional installation of LPR. The Commission has not adopted a specific definition for “professional installation” in any of its rules for unlicensed devices but has rather left it to be assessed on a case-by-case basis as a certification grant condition. Here, LPR devices are commercial products intended to measure industrial types of materials such as coal, gravel, sand piles or waterways such as rivers or dams, and the rules adopted herein prohibit their marketing to residential consumers. The Commission also finds that the installation of these devices is relatively simple, and because they are commercial products, they will typically be handled by people with product knowledge, unlike many part 15 devices that have consumer-oriented applications. Further, the Commission prohibits the marketing of LPR devices to residential consumers. It therefore finds that the operational and marketing restrictions placed on LPR devices are sufficient to avoid harmful interference to authorized radio services without imposing the requirement for professional installation on LPR devices. The Commission also observes that by its operating nature, an LPR device must be directed toward the substance being measured; the device would not operate correctly if there are too many false echoes caused by reflections from various neighboring physical objects. Thus, installation errors or unintentional misuse of the product will require correction to operate effectively and would need no additional hardware or software safeguard. The Commission also requires in the rules

adopted herein that LPRs be installed in a downward position. However, the Commission finds that additionally requiring built-in circuits to prevent transmission in case of installation errors as recommended by EIBASS an unnecessary cost without correlating benefits.

36. The Commission concludes that LPR devices should only be operated when installed in fixed locations, and thus it prohibits hand-held and mobile applications to prevent interference to authorized services in the same or adjacent frequency bands. The record supports this conclusion. YSI Incorporated (YSI) urges us to confirm that “fixed” also means temporary fixed installations, to allow users the flexibility to operate an LPR at different locations to meet diverse measurement needs, without requiring it to remain permanently at a specific fixed location. The Commission clarifies that an LPR may be temporarily affixed to a structure, so long as it operates only when at a fixed location as required by the rules. The Commission prohibits hand-held applications since these could increase the potential for harmful interference to authorized radio services; they could easily be moved, operated while in motion, or operated when not pointed straight downward. The same concerns apply to operating an LPR while it is moving (e.g., while being transported inside a tanker truck), and the rules will prohibit such use. Because the Commission believes that misuse of an LPR will render it ineffective and thus is quite unlikely to be pursued or to occur, it finds that requiring built-in circuits to detect motion as recommended by EIBASS is an unnecessary cost without sufficient correlating benefits.

37. The Commission disagrees with EIBASS’ assertion that the Commission lacks authority to prohibit marketing of LPR devices to certain types of customers or for certain types of applications. It notes that Congress granted the Commission authority to regulate the marketing, offering for sale, sale or use of RF devices in §302 of the Communications Act, and the Commission implemented that authority in §2.803 of its rules. Further, as an unlicensed part 15 device, an LPR is subject to the provisions of §15.5 of the rules, which require the user of a transmitter that causes interference to authorized radio communications to stop operating the transmitter or correct the problem causing the interference. The Commission has the authority to

investigate part 2 and part 15 violations and take action accordingly, including imposing fines and penalties through its Enforcement Bureau's actions. Therefore, the rules provide several safeguards against the improper use of an LPR (e.g., using it for hand-held applications), that could result in harmful interference to authorized spectrum services.

Equipment Certification

38. In the FNPRM, the Commission proposed to permit Telecommunications Certification Bodies (TCBs) to certify LPR devices operating under the proposed rules. The Commission noted that the FNPRM proposals specify direct measurement of emissions within the main beam of the LPR antenna and are consistent with compliance measurement methodologies currently used by TCBs with other types of unlicensed transmitters. The Commission continues to hold this view, and it will allow LPR equipment certification by TCBs in addition to the Commission.

39. In the FNPRM, the Commission recognized that, currently, a certified TLPR device could be approved to operate under other conditions, e.g., outdoor installations in open-air environments, in an enclosure with low RF attenuation characteristics, or with higher power. To allow previously-certified devices to take advantage of any changes proposed in the FNPRM and adopted in this Order, the Commission proposed to allow the responsible party to file for a permissive change in accordance with the existing rules and practices, provided that: (1) the LPR device operates only within the frequency bands authorized by rules proposed herein; (2) measurement data taken in accordance with the measurement procedure proposed above is provided to demonstrate compliance with the new emission limits specified in these proposed rules; and (3) operational changes to the device are being implemented by software upgrade without any hardware change. The Commission continues to believe that these provisions are appropriate because, consistent with our existing practice, they minimize additional certification burdens on applicants without causing an increased potential for harmful interference to

authorized services. The Commission will implement the changes in our equipment certification guidelines for LPRs.

Additional Protection for the Radio Astronomy Service (RAS)

40. Distance Separation and Height Restrictions. As noted above, CORF notes that RAS has primary allocations at 76-77.5 GHz and 78-85 GHz and does not oppose sharing these bands with LPRs provided the Commission adopts certain protections designed to ensure that RAS can operate in the interference-free environment that the service requires for picking up extremely weak signals. More specifically, CORF and NRAO request that these protections include exclusion zones around RAS stations, restrictions on the height of LPR antennas, requirements for antenna installation, a restriction of operations to fixed installations only, and the deployment of a publicly accessible database of all LPR installations. CORF and NRAO state that the ECC Report 139 recommends a geographical region in which LPRs cannot be installed within 4 km from RAS locations and a limit of 15 meters above ground level on LPR antenna height within 40 km of these locations. They request that the Commission require the same distance separation and height restrictions to protect RAS stations, particularly in the 6650-6675.2 MHz (part of the 5.925-7.250GHz band) and 75-85 GHz bands. MCAA, which represents the LPR industry, agrees with the separation distance and height restrictions to protect RAS sites.

41. The Commission did not propose these restrictions in the FNPRM because interference to RAS observatories from downward-looking LPRs is unlikely. First, the ETSI/ECC distance and antenna height limitation requirements are based on the RAS operating environment in Europe where RAS sites are typically found in urban areas; this is a different environment than in the United States, where RAS receivers are commonly located in remote or rural areas, not the industrial areas where LPRs are likely to be found. Second, in the FNPRM, the Commission proposed radiated emission limits for LPRs, designed to ensure that, at 3 meters from the LPR, the reflected emission level is less than the existing general limit of -41.3 dBm EIRP of §15.209, which is the limit currently applicable to part 15 devices, such as computers

and video monitors, which are likely being used inside a RAS site, apparently without harm. Third, RAS receivers discriminate against off-beam signals and are pointed skyward, discriminating against reflected signals that would be reflected from the side or below. Even in the case of LPRs installed over waterways in remote areas, because the radio astronomy observatories typically have control over access to a distance of one kilometer from the telescopes to provide protection from interference caused by uncontrolled RFI sources, the potential for interference caused by LPRs at that distance (one kilometer) would be infinitesimal, when also taking into account the variability in propagation characteristics due to terrain, weather and other factors. Given these factors and the additional operational and marketing restrictions on LPR devices that the Commission adopted herein (e.g., integrated antennas, downward operation, prohibition on marketing to consumers), the Commission does not find that it is necessary to also prohibit LPRs by rule to avoid operating in the line of sight of RAS stations as NRAO requested. While the MCAA does not oppose the restrictions proposed by CORF and NRAO, MCAA represents only a segment of current LPR users of the band and does not necessarily anticipate future uses. Accordingly, the Commission denies CORF and NRAO's requests for separation distances from radio astronomy observatories and for a limitation on LPR antenna height within certain distances of the line of sight of RAS stations.

42. LPR Installation Database. The Commission declines to require a publicly available LPR installation database or to require manufacturers to maintain lists of LPR installation sites. We note that it is customary for the Commission to proceed in a very cautious manner in a waiver proceeding by imposing specific conditions on operations that typically involve new technology products or new applications of existing technologies and with which the Commission may have little or no prior experience regulating. In the case of the waiver grant for TLPR devices operating in the 77-81 GHz band, the Commission requires manufacturers to maintain a list of LPR installation sites as an additional safeguard to permitting LPR operations in a restricted band, even though it expected that TLPR devices would not be operating in close proximity to

radio astronomy sites and thus not likely to cause harmful interference to them. As discussed in the Report and Order, the Commission adopted new rules based on ETSI/ECC's analysis which derived the limits for LPR main-beam emissions by mathematically correlating them with reflected emissions from an LPR; the resulting values are the same as the existing part 15 average emission limit. The LPR main-beam emission limits therefore would maintain the existing level of interference protection to incumbent radio services, including RAS sites -- a level that has already proven to be adequate. The Commission finds that NRAO's recommendation that the NSF be notified of each LPR installation site is an unnecessary cost without countervailing benefits, and agrees with the LPR industry that this could give rise to confidentiality issues. The Commission concludes that the downward-looking operation of LPRs at such emission limits, when combined with the various operating/marketing restrictions, is extremely unlikely to cause harmful interference to radio astronomy telescopes, thereby making a database or list of LPR installation sites, or notification to authorized users unnecessary. Further, the Commission finds that its decision not to require a publicly available database addresses the LPR industry's concern over potential security risks from the disclosure of LPR locations.

43. Cost Benefit Analysis. In the FNPRM, the Commission provided an analysis on the potential costs of the proposed LPR regulation versus its potential benefits. The Commission stated that, because LPR devices need higher power and wider bandwidth than that which is permitted under the existing part 15 rules to fully achieve the potential of this measuring technology, the proposed rules would tender a necessary remedy for LPR devices to operate at the power levels and in the appropriate frequency bands required to deliver the needed accuracy for diverse applications, thereby promoting the expanded development and use of this technology to the benefit of businesses, consumers, and the economy. The Commission tentatively concluded that the proposed higher power levels in the proposed frequency bands would further the development of better and improved level-measuring tools, but these changes would not increase the potential for interference to authorized users beyond what is permitted under the current rules.

The Commission also considered how the proposed rules would help to simplify equipment development and certification of LPR devices, as well as provide a simplified method for measuring the radiated emissions from these devices.

44. Except for a comment from EIBASS, none of the commenters took issue with any of these factors or with our tentative conclusion. EIBASS argues that the FNPRM cost-benefit analysis fails to consider the costs to incumbent TV BAS licensees in the 6 GHz frequency range in tracking down harmful interference caused by unlicensed high power LPRs. The Commission does not anticipate, however, that BAS licensees will incur costs to investigate interference from LPR; it does not find that LPRs will cause harmful interference to BAS or any other licensed user in any of the adopted frequency bands for LPR operation, as discussed at length. The Commission concludes that the rules adopted herein will provide significant benefits to LPR manufacturers and users with no apparent cost to any party.

ORDER

45. In the Order, the Commission dismissed a waiver request from VEGA to operate LPR devices in the 24.6-27 GHz frequency band under §15.252 as moot. The Commission previously held this request in abeyance pending final action in this rulemaking proceeding because this waiver raises issues that are, in part, similar to those raised in the FNPRM.

46. VEGA requested a waiver of §15.252(a) to operate LPR devices in the 24.6-27 GHz frequency band under this section as a fixed structure, either in tanks or in open air. Section 15.252(a) permits the use of field disturbance sensors within the frequency bands 16.2-17.7 GHz and 23.12-29.0 GHz but requires them to be mounted in terrestrial transportation vehicles, whereas VEGA's LPR devices would only be installed at fixed locations. The waiver request also proposed an emission method of measurement that does not take into account boresight emissions. After the release of the FNPRM, VEGA amended this waiver request on June 6, 2012 for permission to market its 6 GHz and 26 GHz LPRs that would comply with the proposed rules. Because the rules the Commission adopted in the Report and Order enables VEGA to operate

LPR devices in the 24.6-27 GHz frequency band without a waiver of the usage restrictions in §15.252(a), VEGA will be able to apply for LPR certification under §15.256 for both in tank and open air applications. Accordingly, the Commission dismissed VEGA's waiver request as moot.

PROCEDURAL MATTERS

Final Regulatory Flexibility Analysis

47. As required by the Regulatory Flexibility Act (RFA),¹ an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Further Notice of Proposed Rulemaking (FNPRM) in ET Docket No. 10-23.² The Commission sought written public comment on the proposals in the FNPRM, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.

A. Need for, and Objectives of, the Report and Order.

48. In this Report and Order, we modify our rules to provide a set of new technical and operational rules to govern the operation of level probing radar (LPR) devices installed both in open-air environments and inside storage tanks (TLPR applications) in the following frequency bands: 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz. To permit LPR operation in the 75-85 GHz band, we also modify the existing §15.205 of the rules to remove the prohibition on intentional emissions in this band. The amended rules will allow devices with accurate and reliable target resolution to identify water levels in rivers and dams or critical levels of materials such as fuel or sewer-treated waste, reducing overflow and spillage and minimizing exposure of maintenance personnel in the case of high risk substances. The amended rules would also, to the extent practicable, harmonize our technical rules for LPR devices with similar European

¹ See 5 U.S.C. 603. The RFA, see 5 U.S.C. 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Public Law No. 104-121, Title II, 110 Stat. 857 (1996), and the Small Business Jobs Act of 2010, Public Law No. 111-240, 124 Stat. 2504 (2010).

² Further Notice of Proposed Rulemaking in ET Docket No. 10-23 (In the Matter of Amendment of part 15 of the Commission's Rules To Establish Regulations for Tank Level Probing Radars in the Frequency Band 77-81 GHz and Amendment of Part 15 of the Commission's Rules To Establish Regulations for Level Probing Radars and Tank Level Probing Radars in the Frequency Bands 5.925-7.250 GHz, 24.05-29.00 GHz and 75-85 GHz), 27 FCC Rcd. 3660 (2012) (FNPRM).

standards and would improve the competitiveness of U.S. manufacturers in the global economy, leading to potential cost savings for small businesses, all without causing harmful interference to authorized spectrum users in the affected frequency bands.

B. Statement of Significant Issues Raised by Public Comments in Response to the IRFA.

49. There were no public comments filed that specifically addressed the rules and policies proposed in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration.

50. Pursuant to the Small Business Jobs Act of 2010, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration, and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply.

51. The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.³ The RFA defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small business concern” under Section 3 of the Small Business Act.⁴ Under the Small Business Act, a “small business concern” is one that: (1) is independently owned and operated; (2) is not dominant in its field of operations; and (3) meets any additional criteria established by the Small Business Administration (SBA).⁵

52. Small Businesses, Small Organizations, and Small Governmental Jurisdictions. Our action may, over time, affect small entities that are not easily categorized at present. We

³ See 5 U.S.C. 603(b)(3).

⁴ Id. 601(3).

⁵ Id. 632.

therefore describe here, at the outset, three comprehensive, statutory small entity size standards that encompass entities that could be directly affected by the proposals under consideration.⁶ As of 2009, small businesses represented 99.9% of the 27.5 million businesses in the United States, according to the SBA.⁷ Additionally, a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”⁸ Nationwide, as of 2007, there were approximately 1,621,315 small organizations.⁹ Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁰ Census Bureau data for 2007 indicate that there were 89,527 governmental jurisdictions in the United States.¹¹ We estimate that, of this total, as many as 88,761 entities may qualify as “small governmental jurisdictions.”¹² Thus, we estimate that most governmental jurisdictions are small.

53. The adopted rules pertain to manufacturers of unlicensed communications devices.

The appropriate small business size standard is that which the SBA has established for radio and television broadcasting and wireless communications equipment manufacturing. The Census

⁶ See 5 U.S.C. 601(3)–(6).

⁷ See SBA, Office of Advocacy, “Frequently Asked Questions,” available at <http://web.sba.gov/faqs/faqindex.cfm?areaID=24> (last visited Aug. 31, 2012).

⁸ 5 U.S.C. 601(4).

⁹ INDEPENDENT SECTOR, THE NEW NONPROFIT ALMANAC & DESK REFERENCE (2010).

¹⁰ 5 U.S.C. 601(5).

¹¹ U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2011, Table 427 (2007).

¹² The 2007 U.S. Census data for small governmental organizations are not presented based on the size of the population in each such organization. There were 89,476 local governmental organizations in 2007. If we assume that county, municipal, township, and school district organizations are more likely than larger governmental organizations to have populations of 50,000 or less, the total of these organizations is 52,095. If we make the same population assumption about special districts, specifically that they are likely to have a population of 50,000 or less, and also assume that special districts are different from county, municipal, township, and school districts, in 2007 there were 37,381 such special districts. Therefore, there are a total of 89,476 local government organizations. As a basis of estimating how many of these 89,476 local government organizations were small, in 2011, we note that there were a total of 715 cities and towns (incorporated places and minor civil divisions) with populations over 50,000. CITY AND TOWNS TOTALS: VINTAGE 2011 – U.S. Census Bureau, *available at* <http://www.census.gov/popest/data/cities/totals/2011/index.html>. If we subtract the 715 cities and towns that meet or exceed the 50,000 population threshold, we conclude that approximately 88,761 are small. U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES 2011, Tables 427, 426 (Data cited therein are from 2007).

Bureau defines this category as follows: “This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.”¹³ The SBA has developed a small business size standard for firms in this category, which is: all such firms having 750 or fewer employees.¹⁴ According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for part or all of the entire year. Of this total, 784 had less than 500 employees and 155 had more than 100 employees.¹⁵ Thus, under this size standard, the majority of firms can be considered small.

E. Description of Projected Reporting, Record keeping and Other Compliance Requirements for Small Entities.

54. Unlicensed devices operating in the 5.925-7.250 GHz and 24.05-29.00 GHz band are already required to be authorized under the Commission's certification procedure as a prerequisite to marketing and importation, and the Report and Order makes no change to that requirement. See 47 CFR §§ 15.101, 15.201, 15.250, and 15.252. Currently, the 75-85 GHz band is a restricted band in which unlicensed device may not only transmit spurious (unintentional) emissions. The Report and Order modifies the existing §15.205, 47 CFR § 15.205, of the rules to remove the prohibition on intentional emissions in this band and adopt the same certification procedures for level probing radars operating in this band as for the other above-listed frequency bands. The technical requirements adopted in this Report and Order, do not impose significant burden and will not have a significant economic impact on a substantial number of small entities

¹³ U.S. Census Bureau, 2007 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing”; <http://www.census.gov/naics/2007/def/ND334220.HTM#N334220>.

¹⁴ 13 CFR 121.201, NAICS code 334220.

¹⁵ http://factfinder.census.gov/servlet/IBQTable?_bm=y&-fds_name=EC0700A1&-geo_id=&-_skip=300&-ds_name=EC0731SG2&-_lang=en.

that are, or may be, subject to the requirements of the rules in the item.

F. Steps taken to Minimize Significant Economic Impact on Small Entities and Significant Alternatives Considered

55. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.¹⁶

56. In this Report and Order, we modify our rules to provide a set of new technical and operational rules to govern the operation of LPR devices installed both in open-air environments and inside storage tanks (TLPR applications) in the following frequency bands: 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz. To permit LPR operation in the 75-85 GHz band, we also modify the existing §15.205 of the rules to remove the prohibition on intentional emissions in this band. These rule changes will provide needed flexibility and cost savings for LPR devices, benefiting the U.S. consumers and manufacturers without causing harmful interference to authorized services. The amended rules will allow devices with accurate and reliable target resolution to identify water levels in rivers and dams or critical levels of materials such as fuel or sewer-treated waste, reducing overflow and spillage and minimizing exposure of maintenance personnel in the case of high risk substances. The amended rules would also, to the extent practicable, harmonize our technical rules for LPR devices with similar European standards and would improve the competitiveness of U.S. manufacturers in the global economy, leading to potential cost savings for small businesses. We find that the benefits of the above

¹⁶ 5 U.S.C. 603(c).

changes to the rules outweigh their regulatory costs. We believe that the adopted rules will apply equally to large and small entities. Therefore, there is no inequitable impact on small entities.

ORDERING CLAUSES

57. Pursuant to sections 4(i), 301, 302, 303(e), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 301, 302a, 303(e), 303(f), 303(g), and 303(r), this Report and Order is hereby ADOPTED and part 15 of the Commission's Rules ARE AMENDED as set forth in the Appendix, effective **[30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

58. Pursuant to authority in §1.3 of the Commission's rules, 47 CFR 1.3, and 4(i), 302, and 303(e), of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 302, and 303(e), the Request for Waiver filed by VEGA Americas, Inc. (formerly Ohmart/VEGA Corporation) filed on December 3, 2009, ET Docket No. 10-27, **IS DISMISSED**, consistent with the terms of this Order. This action is effective upon release of this Order.

59. **Report to Congress:** The Commission will send a copy of the Report and Order, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act.¹⁷ In addition, the Commission will send a copy of the Report and Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA.

List of Subjects in 47 CFR Part 15

Communications equipment, Radio.

FEDERAL COMMUNICATIONS COMMISSION.

Marlene H. Dortch,
Secretary.

¹⁷ See 5 U.S.C. 801(a)(1)(A).

Final Rule Changes

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 of the Code of Federal Regulations part 15 to read as follows:

Part 15 – RADIO FREQUENCY DEVICES

1. The authority citation for part 15 continues to read as follows:

Authority: 47 U.S.C. 154, 202, 303, 304, 307 and 544A.

2. Section 15.3 is amended by adding paragraph (ii) to read as follows:

§ 15.3 Definitions.

* * * * *

(ii) Level Probing Radar (LPR): A short-range radar transmitter used in a wide range of applications to measure the amount of various substances, mostly liquids or granulates. LPR equipment may operate in open-air environments or inside an enclosure containing the substance being measured.

3. Section 15.31 is amended by revising paragraphs (c) and (g) and adding paragraph (q) to read as follows:

§ 15.31 Measurement standards.

* * * * *

(c) Except as otherwise indicated in § 15.256, for swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

* * * * *

(g) Equipment under test shall be positioned and adjusted, using those controls that are readily accessible to or are intended to be accessible to the consumer, in such a manner as to maximize the level of the emissions. For those devices to which wire leads may be attached by

the operator, tests shall be performed with wire leads attached. The wire leads shall be of the length to be used with the equipment if that length is known. Otherwise, wire leads one meter in length shall be attached to the equipment. Longer wire leads may be employed if necessary to interconnect to associated peripherals.

* * * * *

(q) As an alternative to § 15.256, a level probing radar (LPR) may be certified as an intentional radiator by showing compliance with the general provisions for operation under part 15 subpart C of this chapter, provided that the device is tested in accordance with the provisions in either paragraphs (q)(1) or (2) of this section. Compliance with the general provisions for an intentional radiator may require compliance with other rules in this part, e.g., §§ 15.5, 15.31, and 15.35, etc., when referenced.

(1) An LPR device intended for installation inside metal and concrete enclosures may show compliance for radiated emissions when measured outside a representative enclosure with the LPR installed inside, in accordance with the measurement guidelines established by the Commission for these devices. LPR devices operating inside these types of enclosures shall ensure that the enclosure is closed when the radar device is operating. Care shall be taken to ensure that gaskets, flanges, and other openings are sealed to eliminate signal leakage outside of the structure. The responsible party shall take reasonable steps to ensure that LPR devices intended for use in these types of enclosures shall not be installed in open-air environments or inside enclosures with lower radio-frequency attenuating characteristics (e.g., fiberglass, plastic, etc.). An LPR device approved under this subsection may only be operated in the type of enclosure for which it was approved.

(2) Except as provided in paragraph (q)(1) of this section, an LPR device shall be placed in testing positions that ensure the field strength values of the radiated emissions are maximized, including in the main beam of the LPR antenna.

4. Section 15.35 is amended by revising paragraphs (b) and (c) to read as follows:

§ 15.35 Measurement detector functions and bandwidths.

* * * * *

(b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

(c) Unless otherwise specified, e.g., §§ 15.255(b), and 15.256(l)(5), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for

equipment subject to notification or verification.

5. Section 15.205 is amended by revising paragraph (d)(4) to read as follows:

§ 15.205 Restricted bands of operation.

* * * *

(d) * * *

(4) Any equipment operated under the provisions of § 15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or § 15.257 of this part.

* * * *

6. Section 15.256 is added to read as follows:

§ 15.256 Operation of level probing radars within the bands 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz.

(a) Operation under this section is limited to level probing radar (LPR) devices.

(b) LPR devices operating under the provisions of this section shall utilize a dedicated or integrated transmit antenna, and the system shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam.

(c) LPR devices operating under the provisions of this section shall be installed only at fixed locations. The LPR device shall not operate while being moved, or while inside a moving container.

(d) Hand-held applications are prohibited.

(e) Marketing to residential consumers is prohibited.

(f) The fundamental bandwidth of an LPR emission is defined as the width of the signal between two points, one below and one above the center frequency, outside of which all emissions are attenuated by at least 10 dB relative to the maximum transmitter output power when measured in an equivalent resolution bandwidth.

(1) The minimum fundamental emission bandwidth shall be 50 MHz for LPR operation under the provisions of this section.

(2) LPR devices operating under this section must confine their fundamental emission bandwidth within the 5.925-7.250 GHz, 24.05-29.00 GHz, and 75-85 GHz bands under all conditions of operation.

(g) Fundamental emissions limits. (1) All emission limits provided in this section are expressed in terms of Equivalent Isotropic Radiated Power (EIRP).

(2) The EIRP level is to be determined from the maximum measured power within a specified bandwidth.

(i) The EIRP in 1 MHz is computed from the maximum power level measured within any 1-MHz bandwidth using a power averaging detector;

(ii) The EIRP in 50 MHz is computed from the maximum power level measured with a peak detector in a 50-MHz bandwidth centered on the frequency at which the maximum average power level is realized and this 50 MHz bandwidth must be contained within the authorized operating bandwidth.

For a RBW less than 50 MHz, the peak EIRP limit (in dBm) is reduced by $20 \log(\text{RBW}/50)$ dB where RBW is the resolution bandwidth in megahertz. The RBW shall not be lower than 1 MHz or greater than 50 MHz. The video bandwidth of the measurement instrument shall not be less than the RBW. If the RBW is greater than 3 MHz, the application for certification filed shall contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

(3) The EIRP limits for LPR operations in the bands authorized by this rule section are provided in Table 1. The emission limits in Table 1 are based on boresight measurements (*i.e.*, measurements performed within the main beam of an LPR antenna).

| Frequency Band of Operation (GHz) | Average Emission Limit (EIRP in dBm measured in 1 MHz) | Peak Emission Limit (EIRP in dBm measured in 50 MHz) |
|--|---|---|
| 5.925-7.250 | -33 | 7 |
| 24.05-29.00 | -14 | 26 |
| 75-85 | -3 | 34 |

Table 1 – LPR EIRP emission limits

(h) Unwanted emissions limits. Unwanted emissions from LPR devices shall not exceed the general emission limit in § 15.209 of this chapter.

(i) Antenna beamwidth. (A) LPR devices operating under the provisions of this section within the 5.925-7.250 GHz and 24.05-29.00 GHz bands must use an antenna with a -3 dB beamwidth no greater than 12 degrees.

(B) LPR devices operating under the provisions of this section within the 75-85 GHz band must use an antenna with a -3 dB beamwidth no greater than 8 degrees.

(j) Antenna side lobe gain. LPR devices operating under the provisions of this section must limit the side lobe antenna gain relative to the main beam gain for off-axis angles from the main beam of greater than 60 degrees to the levels provided in Table 2.

| Frequency Range (GHz) | Antenna Side Lobe Gain Limit Relative to Main Beam Gain (dB) |
|------------------------------|---|
| 5.925-7.250 | -22 |
| 24.05-29.00 | -27 |
| 75-85 | -38 |

Table 2 – Antenna side lobe gain limits

(k) Emissions from digital circuitry used to enable the operation of the transmitter may comply with the limits in § 15.209 of this chapter provided it can be clearly demonstrated that those emissions are due solely to emissions from digital circuitry contained within the transmitter and the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated

digital devices, as defined in § 15.3(k) of this part, e.g., emissions from digital circuitry used to control additional functions or capabilities other than the operation of the transmitter, are subject to the limits contained in subpart B, part 15 of this chapter. Emissions from these digital circuits shall not be employed in determining the -10 dB bandwidth of the fundamental emission or the frequency at which the highest emission level occurs.

(1) Measurement procedures. (1) Radiated measurements of the fundamental emission bandwidth and power shall be made with maximum main-beam coupling between the LPR and test antennas (boresight).

(2) Measurements of the unwanted emissions radiating from an LPR shall be made utilizing elevation and azimuth scans to determine the location at which the emissions are maximized.

(3) All emissions at and below 1000 MHz except 9-90 kHz and 110-490 kHz bands are based on measurements employing a CISPR quasi-peak detector.

(4) The fundamental emission bandwidth measurement shall be made using a peak detector with a resolution bandwidth of 1 MHz and a video bandwidth of at least 3 MHz.

(5) The provisions in §15.35(b) and (c) of this part that require emissions to be averaged over a 100 millisecond period and that limits the peak power to 20 dB above the average limit do not apply to devices operating under paragraphs (a) through (1) of this section.

(6) Compliance measurements for minimum emission bandwidth of frequency-agile LPR devices shall be performed with any related frequency sweep, step, or hop function activated.

(7) Compliance measurements shall be made in accordance with the specific procedures published or otherwise authorized by the Commission.

[FR Doc. 2014-04733 Filed 03/05/2014 at 8:45 am; Publication Date: 03/06/2014]